	INDIAN SCHOOL AL WADI AL KABIR	
Class: XI	**Department: SCIENCE 2022 - 23** **SUBJECT: PHYSICS**	**Date of submission:** **14/1/2023**
Worksheet No: 08 **WITH ANSWERS**	**CHAPTER: GRAVITATION**	**Note:** **A4 FILE FORMAT**
Name of the student:	**Class & Sec:**	**Roll No:**

OBJECTIVE TYPE QUESTIONS

1. **What is the unit of Universal Gravitational Constant in SI unit?**
   A: N-m-Kg
   B: N/m-Kg
   C: N-m^2/Kg^2
   D: N/m^2-Kg
2. **Does escape velocity of a body depend on its mass?**
   A: Yes
   B: No
3. **If a stone brought back to earth from moon, then its**
   A: mass will be changed
   B: mass and weight will be changed
   C: Weight never be changed
   D: mass remain constant but weight will be changed
4. **Gravitational potential is –**
   A: proportional to distance
   B: inversely proportional to distance
   C: proportional to the square of the distance
   D: inversely proportional to the square of the distance
5. **If we double the distance between two objects, gravitational force will be**
   A: double
   B: half
   C: one fourth
   D: 4 times greater
6. **A man weighs 50 kg at earth's surface. At what height above the earth's surface his weight becomes half (Radius of earth = 6400 km) :**
   (a) 2526 km
   (b) 6400 km
   (c) 2650 km
   (d) 3200 km

7. **The escape velocity on the surface of earth is Ve. If body is thrown with twice this velocity then what will be its velocity after escaping the gravitational field :**
(a) V_e
(b) √2 V_e
(c) √3 V_e
(d) (1/ 2) V_e

8. **With what velocity should a body be thrown up so that it rises to a height equal to the radius of the earth (g = 10 m s–2 at the surface) ?**
(a) 8000 m /s
(b) 6400 m/ s
(c) 1600 m/ s
(d) 1000 m/ s

9. **The time period of planet X around sun is 8 times that of Y. The distance of X from the sun is how many times greater than that of Y?**
(a) 4 times
(b) 3 times
(c) 13/ 2 times
(d) 11/2 times.

10. **If both the mass and radius of earth decrease by 1%, the value of acceleration due to gravity will decrease by nearly :**
(a) l%
(b) 2%
(c) 1·5%
(d) 2·5%

Read the assertion and reason carefully to mark the correct option out of the options given below:

A) If both assertion and reason are true and the reason is the correct explanation of the assertion.
B) If both assertion and reason are true but reason is not the correct explanation of the assertion.
C)If assertion is true but reason is false.
D)the assertion and reason both are false.
E) If assertion is false but reason is true.

11. **Assertion**: Smaller the orbit of the planet around the sun, shorter is the time it takes to complete one revolution.
Reason: According to Kepler’s third law of planetary motion, square of time period is proportional to cube of mean distance from sun.

12. **Assertion** : The universal gravitational constant is same as acceleration due to gravity.
Reason: Gravitational constant and acceleration due to gravity have same dimensional formula.

13. Assertion: The value of acceleration due to gravity does not depend upon mass of the body on which force is applied.

Reason : Acceleration due to gravity is a constant quantity.

14. Assertion : A planet moves faster, when it is closer to the sun in its orbit and vice versa.

Reason : Orbital velocity in orbital of planet is constant.

VERY SHORT ANSWER QUESTIONS (BASIC LEVEL)

15. Can gravitational potential have positive value?

16. An elephant and an ant are to be projected out of the gravitational pull of the earth. Do we need different velocities to achieve so?

17. Why G is called universal gravitation constant?

18. What is the weight of the body at the centre of the earth?

SHORT ANSWER QUESTIONS - (INTERMEDIATE LEVEL):

19. Define escape velocity. Derive an expression for the escape velocity of a body from the surface of Earth.

20. Define acceleration due to gravity and show that gravity decreases with depth

21. Gravitational force between two bodies is 1 N. If the distance between them is made twice, what will be the force?

22.(i) Define gravitational potential at a point. Is it scalar or vector quantity?

(ii) Obtain an expression for gravitational potential at a point due to earth.

ADVANCED LEVEL QUESTIONS

23. i. State Kepler's laws of planetary motion.

ii. The time period of a satellite of earth is 5 hours. If the separation between the earth and the satellite is increased to four times the previous value, what will be its new time period?

24. i. State Newton's law of gravitation.

ii. The radius of moon is 1.7×10^6m and its mass is 7.35×10^{22}kg. What is the acceleration due to gravity on the surface of the moon? ($G=6.67\times10^{-11}Nm^2kg^{-2}$)

25. (a)On a planet, whose size is the same and mass three times as that of the earth, find the amount of work done to lift 5kg mass vertically upwards through 5m on the planet.

(The value of g on the surface of the earth is $9.8m/s^2$)

(b) At what height above the earth's surface, the value of 'g' is the same as in a mine 80km deep?

26. What is orbital velocity of a satellite? Derive an expression to find the orbital velocity of a satellite, when it is at a height of 'h' from the surface of Earth.

27. A body weighs 90kg on the surface of the earth. How much will it weigh on the surface of the mars, whose mass is 1/9 and radius is ½ of that of the earth? (CBSE)

ANSWERS:

1	C: $N\text{-}m^2/Kg^2$
2	B: No
3	D: mass remain constant but weight will be changed
4	B: inversely proportional to distance
5	C: one fourth
6	$\frac{mg'}{mg}=\frac{1}{2} \Rightarrow \frac{g'}{g}=\frac{1}{2}$ or $\frac{R^2}{(R+h)^2}=\frac{1}{2} \Rightarrow \frac{R}{R+h}=\frac{1}{\sqrt{2}}$ $\therefore \sqrt{2}\,R = R+h$ $h=(\sqrt{2}-1)R = 0{\cdot}414\times 6400 = 2650$ km.
7	Initial energy = work done to escape + final K.E. $\Rightarrow \frac{1}{2}mU^2 = \frac{1}{2}mv_e^2 + \frac{1}{2}mv^2$ $\Rightarrow (2v_e)^2 = v_e^2 + v^2 \Rightarrow v=\sqrt{3}v_e$
8	$v=\sqrt{gR}=\sqrt{10\times 6{\cdot}4\times 10^6} = 8000$ m/s
9	$\frac{T_1^2}{T_2^2}=\left(\frac{R_1}{R_2}\right)^3 \Rightarrow \frac{R_1}{R_2}=\left(\frac{T_1}{T_2}\right)^{2/3}$ $\frac{R_1}{R_2}=(8)^{2/3} \Rightarrow R_1=4R_2.$
10	$\frac{g'}{g}=\frac{M'}{M}\times\left(\frac{R}{R'}\right)^2=\frac{0{\cdot}99M}{M}\left(\frac{R}{{\cdot}99R}\right)^2=1{\cdot}01$ $\therefore \frac{g'}{g}-1=1{\cdot}01-1 \Rightarrow \frac{g'-g}{g}=0{\cdot}01$ or $\frac{g'-g}{g}\times 100 = 1\%$
11	both assertion and reason are true and the reason is the correct explanation of the assertion.
12	the assertion and reason both are false.
13	Both assertion and reason are true and the reason is the correct explanation of the assertion
14	both assertion and reason are true but reason is not the correct explanation of the assertion
15	The gravitational potential is always a negative value. This is because: It is defined as zero at infinity.
16	Both should be projected with the same velocity
17	**Its value is constant anywhere in the Universe**, and hence it's called 'Universal'.
18	zero
19	As given in the notes
20	As given in the notes

21	$F=\frac{GMm}{R^2}=1$ Now the distance between both the bodies is made twice R'=2R The new gravitational force will be $F'=\frac{GMm}{R'^2}$ $F'=\frac{GMm}{(2R)^2}$ $F'=\frac{1}{4}\frac{GMm}{R^2}$ $F'=\frac{1}{4}F$ $F'=\frac{1}{4}\times 1$ $F'=0.25\ N$
22	As given in notes
23	i) As given in the notes ii) $T^2 \propto R^3$ $\Rightarrow \left(\frac{T_1}{T_2}\right)^2=\left(\frac{R_1}{R_2}\right)^3$ $\Rightarrow \left(\frac{T_1}{T_2}\right)=\left(\frac{R_1}{R_2}\right)^{3/2}=\left(\frac{1}{4}\right)^{3/2}$ $\Rightarrow \frac{T_2}{T_1}=(4)^{3/2}=8$ $\Rightarrow T_2=8\times T_1=8\times 5=40$ hours
24	i) As given in the notes ii) g = GM/R^2 g = 6.67×10^-11 × 7.35×10^22 / (1.7×10^6)^2 g = 1.7 m/s^2
25	On the earth, acceleration due to gravity is $g=\frac{GM}{R^2}$ On the other planet whose mass $M.=3M$, acceleration due to gravity is $g.=\frac{GM.}{R^2}=\frac{3GM}{R^2}=3g$ Energy required to raise the mass m = 5g by height h = 5m is equal to work done on it. W = mg. h $=5\times 3g\times 5$ $=5\times 3\times 10\times 5=750J$ *g(1- 2h/R) = g(1- d/R)* *⇒ 1- 2h/R = 1- d/R* *⇒ 2h/R = d/R* *⇒ 2h = d* *⇒ 2h = 80 Km* *⇒* ***h = 40 Km*** *(Ans.)*

26	As given in the notes
27	Therefore, $F = mg = m\frac{GM}{R_e^2}$ $\frac{F_{Mars}}{F_{Earth}} = \frac{m[GM/R_e^2]\vert_{Mars}}{m[GM/R_e^2]\vert_{Earth}}$ $\frac{F_{Mars}}{90kg} = \frac{(M_{earth}/9)}{(M_{earth})} \times \frac{(R_{Earth})^2}{(R_{Earth}/2)^2} = 4/9$ $F_{Mars} = 90 \times 4/9 = 40kg$

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